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Towards Computing Pointwise Repairs in a Fragment of DatalogMTL

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Introduction

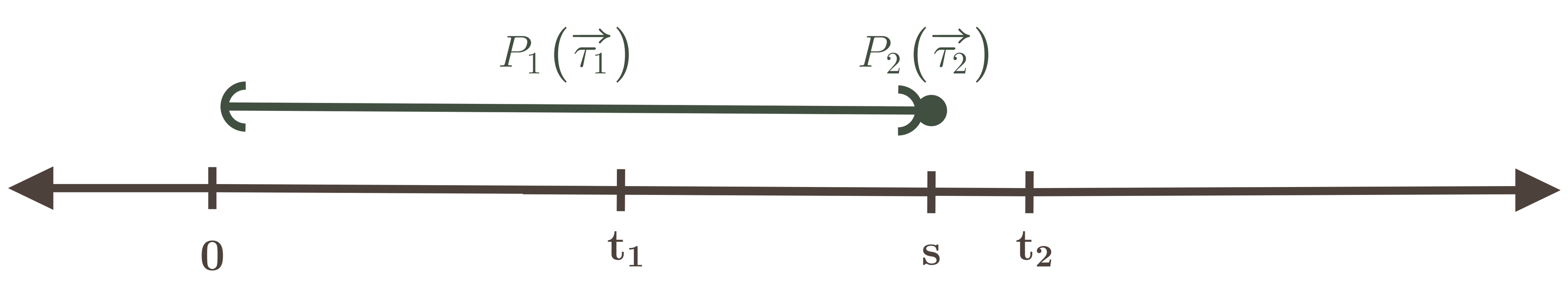
Starting Point:
- DatalogMTL
- Inconsistency-Handling
- Repairs (granularity of KB statements)

Our Focus:
- Inconsistency-Handling in DatalogMTL
- Pointwise Repairs (fine-grained, sub-statement)

Language Considered:
- DatalogMTL$^{\diamondminus}$

DatalogMTL

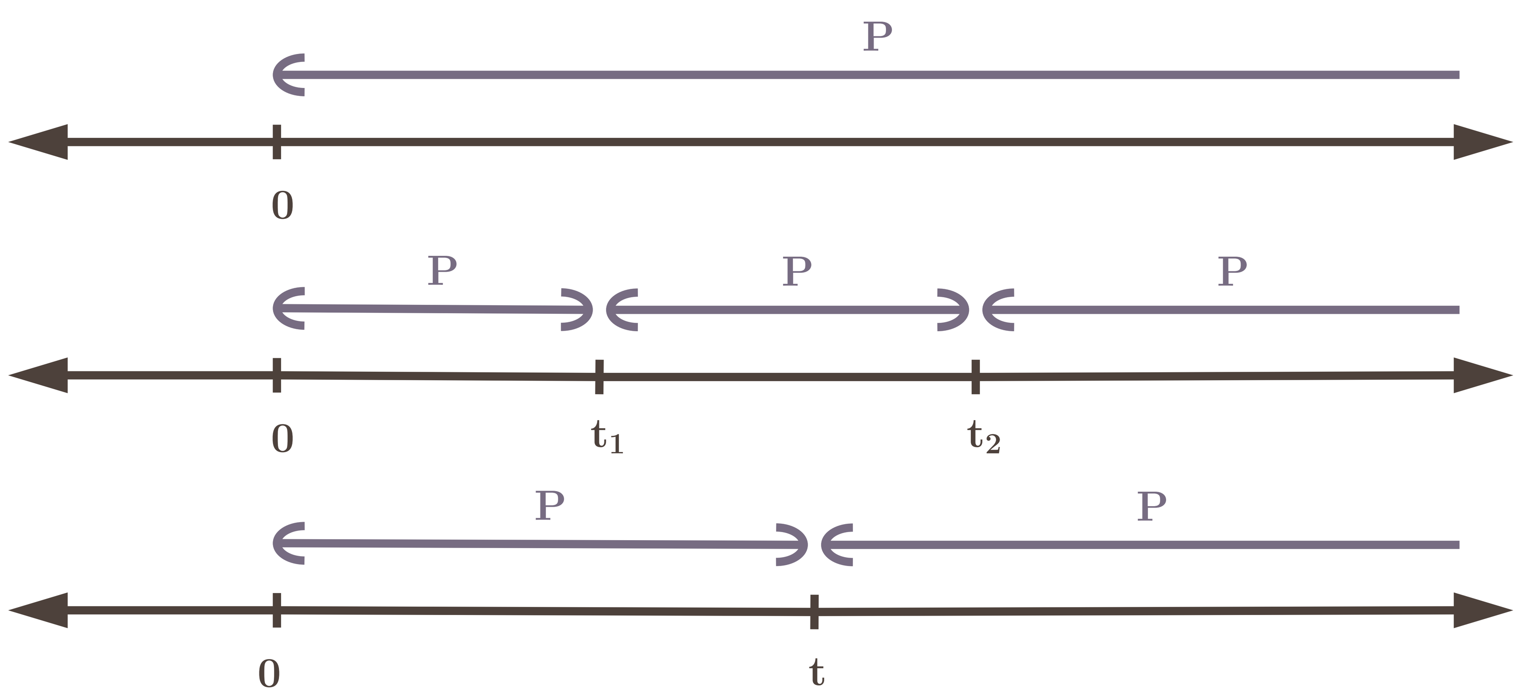
- $\diamondminus_{(t_1,t_2)} P_2(\vec{\tau}_2)$
- $\boxminus_{(0,s)} P_1(\vec{\tau}_1)$
- $P_1(\vec{\tau}_1)\mathcal{U}_{(t_1,t_2)} P_2(\vec{\tau}_2)$



Examples

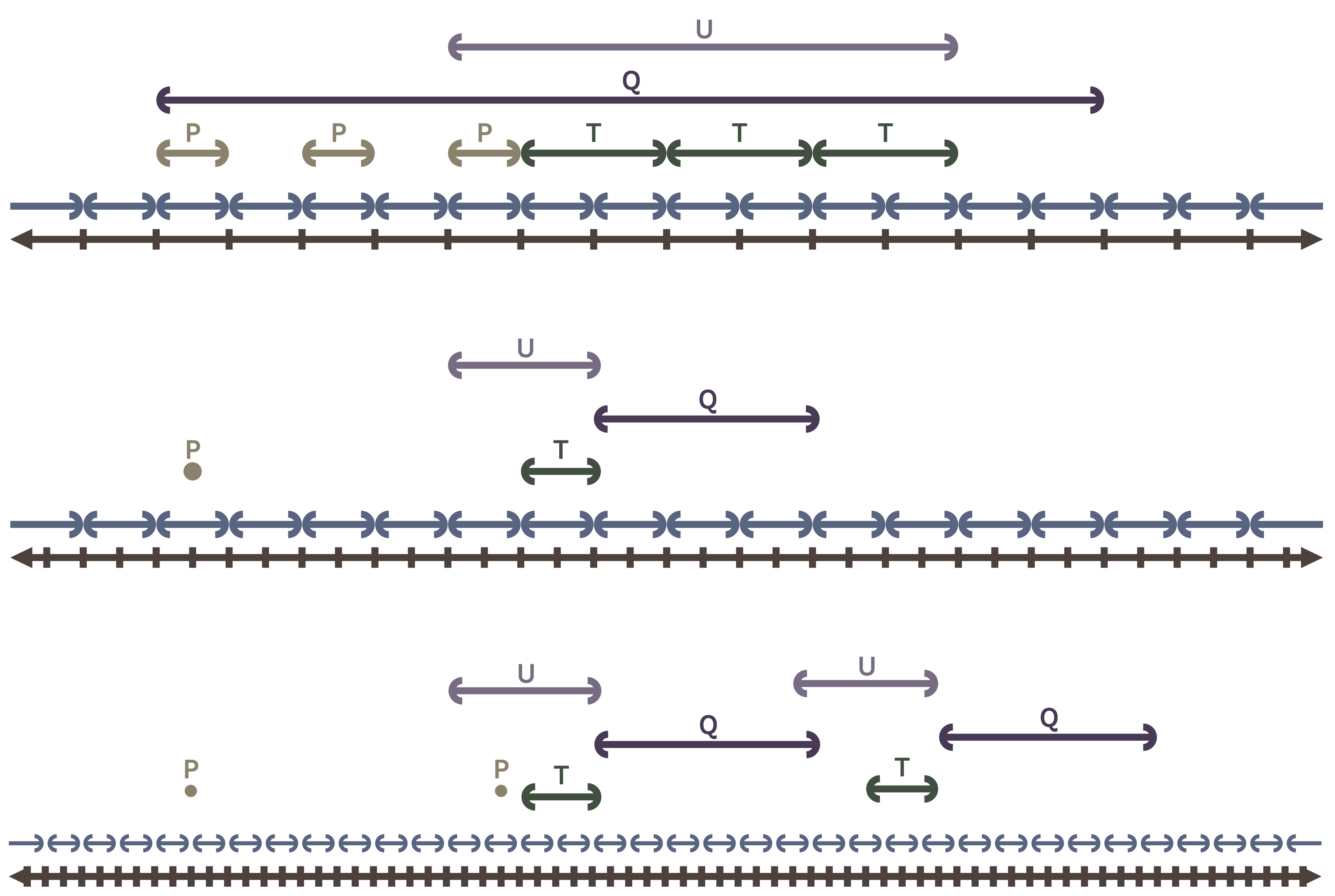
Do pointwise repairs always exist?

$$\Pi_2 = \{\bot \leftarrow \boxminus_{(0,\infty)} P\}, \qquad \mathcal{D}_2 = \{P@(0,\infty)\}$$



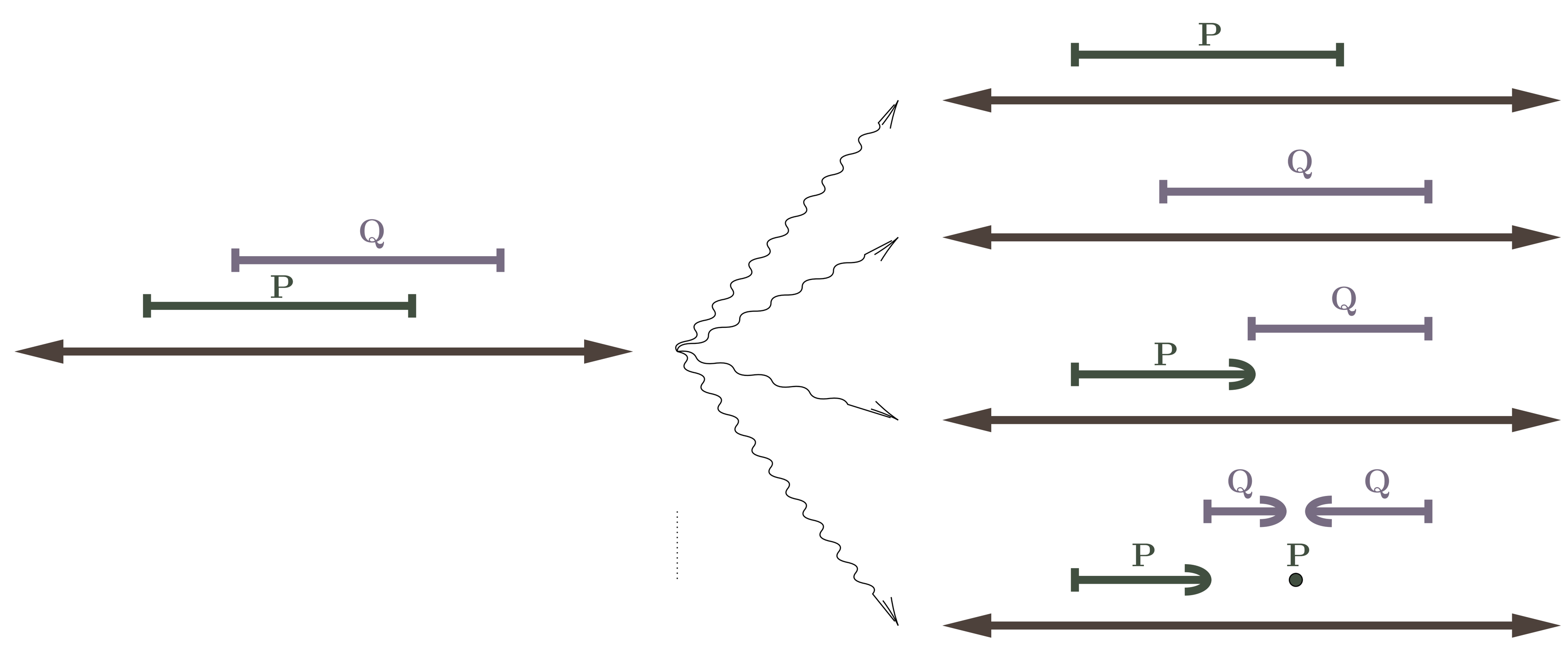
Let us compute a pointwise repair!

$$\Pi_3 = \{Q \leftarrow \diamondminus_{(6,9)} P, U \leftarrow \diamondminus_{(4,6)} P, T \leftarrow \diamondminus_{(5,6)} P,$$
$$\bot \leftarrow Q \land U, \bot \leftarrow Q \land T,$$
$$\bot \leftarrow P \land \diamondminus_{\{4\}} P, \bot \leftarrow P \land \diamondminus_{(1,3)} P\}$$
$$, \mathcal{D}_3 = \{P@(0,1),\ P@(2,3),\ P@(4,5)\}$$



Pointwise Repair

$$\Pi_1 = \{\bot \leftarrow P \land Q\}, \qquad \mathcal{D}_1 = \{P@[0,3],\ Q@[1,4]\}$$



Pointwise repair computation algorithm for datalogMTL$^{\diamondminus}$

Algorithm 1: PRepair$^{\diamondminus}(\Pi, \mathcal{D})$

Input: A datalogMTL$^{\diamondminus}$ program Π and a dataset $\mathcal{D}$
Output: A pointwise repair $\mathcal{R}$ of $\mathcal{D}$ w.r.t. Π

$\mathcal{D}' :=$ Discretize$(\mathcal{D}, \mathrm{gcd}(\Pi, \mathcal{D}))$
$\mathcal{R} := \varnothing$ and $S := \varnothing$
foreach $P(\vec{c})@\iota \in \mathcal{D}'$ **do**
  if $\mathcal{R} \cup \{P(\vec{c})@\iota\}$ **is** Π**-consistent then** $\mathcal{R} := \mathcal{R} \cup \{P(\vec{c})@\iota\}$;
  else if ι **is not punctual then** $S := S \cup \{\{P(\vec{c})@\iota\}\}$;
repeat
  pick $\mathcal{V} \in S$, $P(\vec{c})@\iota \in \mathcal{V}$, and $t \in \iota$;
  $\mathcal{V} := \mathcal{V} \dot{-} \{P(\vec{c})@\iota\}$;
  if $\mathcal{R} \cup \{P(\vec{c})@\{t\}\}$ **is** Π**-consistent then**
    $\mathcal{R} := \mathcal{R} \cup \{P(\vec{c})@\{t\}\}$;
    $S := S \dot{-} \{\mathcal{V}\}$;
    if $\bigcup S$ **is not a** $(\Pi, \mathcal{R})$**-dataset then**
      foreach $\mathcal{V}' \in S$ **do** $\mathcal{V}' :=$ Discretize$(\mathcal{V}', \mathrm{gcd}(\Pi, \mathcal{R}))$;
until S **is empty**;
return $\mathcal{R}$

Conclusion and Future Work

√ Solving the existence problem of pointwise repairs for datalogMTL$^{\diamondminus}$
√ (Incomplete) pointwise repair computation algorithm for a fragment of datalogMTL
√ Decision procedure for existence of pointwise repairs in datalogMTL$^{\diamondminus}$
! characterisation for the (non-)existence of pointwise repairs
! investigate the complexity of the existence problem

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